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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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EXAMINER	
MALDONADO, JULIO J	

ART UNIT	PAPER NUMBER
2823	

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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/563,854	YOON ET AL.	
	Examiner	Art Unit	
	JULIO J. MALDONADO	2823	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *08 December 2008*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-19* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-13 and 15-19* is/are rejected.

7)☒ Claim(s) *14* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 12/08/2008 has been entered.

Allowable Subject Matter

2. The indicated allowability of claim 14 is withdrawn in further review of the prior art of record. Rejections based on the newly cited reference(s) follow.

Claim Rejections - 35 USC § 103

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

4. Claims 1-6, 8-12, 14 and 16-19 are rejected under 35 U.S.C. 103(a) as being unpatentable over Chua et al. (U.S. 6,455,340 B1, hereinafter Chua) in view of Kelly et al. (U.S. 6,740,604 B2, hereinafter Kelly).

In reference to claims 1, 5, 6 and 16-19, Chua (Figs.1-3) discloses a method of forming a nitride semiconductor layer including the steps of growing a second nitride (106) semiconductor epitaxial layer on a first nitride semiconductor epitaxial layer (102, 104), wherein said second nitride semiconductor layer is made of InGaN (Chua, column 5, lines 8 – 13) and said first nitride (102, 104) semiconductor layer is made of GaN (Chua column 4, lines 39 – 51); a second step of growing a third nitride (114) made of GaN on the second nitride semiconductor epitaxial layer (106) (Chua, column 5, lines 21 – 31); and a third step of releasing nitrogen from the second nitride semiconductor epitaxial layer (104) using an excimer laser procedure (Chua, column 6, lines 14 – 23), wherein laser procedures introduces a thermoelastic stress due to the rapid heating and cooling during the said procedure (Chua, column 2, lines 56 – 65).

Chua fails to disclose a deposition temperature for said third nitride semiconductor layer. However, Chua is open to form GaN layers at temperatures, for example, from 500^{o}C to 600^{o}C and from 1000^{o}C to 1200^{o}C (Chua, column 4, lines 52 – 65) and furthermore, wherein laser procedures introduces a thermoelastic stress due to the rapid heating and cooling during the said procedure (Chua, column 2, lines 56 – 65).

Therefore, one of ordinary skill in the art at the time the invention was made would have used the available teachings contained in Chua to deposit the GaN layer at one of the recited deposition temperature ranges.

Chua fails to expressly disclose fails to expressly disclose releasing said nitrogen from said InGaN layer at a temperature greater than the deposition temperature of said GaN.

However, Kelly teaches a method of forming nitride semiconductor layers including forming III-nitride semiconductor layers and performing a decomposition process on a III-nitride semiconductor layer, wherein said III-nitride layers are decomposed at temperatures between 600°C to 1800°C (Kelly, column 8, lines 8 – 58).

It would have been within the scope of one of ordinary skill in the art to combine the teachings of Chua and Kelly to enable releasing the nitrogen from the InGaN layer of Chua according to the teachings of Kelly because one of ordinary skill in the art would have been motivated to look to analogous art teaching alternative suitable or useful methods of releasing the nitrogen in the InGaN layer of Chua and art recognized suitability for an intended purpose has been recognized to be motivation to combine. MPEP 2144.07.

The combined teachings of Chua and Kelly fail to expressly dislcose wherein the heating of the first nitride semiconductor layer collectively increases the temperature of the first, second and third nitride semiconductor layer to said third temperature.

However, the recited limitation is seen as a heating step on the first nitride layer at a third temperature, and said heating inherently increases the temperature of the other layers. Therefore, the combined teachings of Chua and Kelly inherently teach the recited limitations.

The combination of Chua and Kelly fail to expressly disclose wherein the first nitride semiconductor epitaxial layer and the third nitride semiconductor epitaxial layer retain their respective nitrogen when the second nitride semiconductor epitaxial layer reaches the third temperature.

However, the combination of Chua and Kelly discloses using the same material and performing the separation by adjusting a heat source such that it decompose the second nitride layer (Chua, column 6, lines 14 - 40), such that the decomposition heat is concentrated on said nitride (Kelly, column 8, lines 43 - 58).

Therefore, since the combination of Chua and Kelly is directed to decompose only the second semiconductor nitride epitaxial layer, the selection of the desired heat specification parameters is obvious because it is a matter of determining optimum process condition by routine experimentation with a limited number of species to obtain a desired decomposed epitaxial layer. In re Jones, 162 USPQ 224 (CCPA 1955)(the selection of optimum ranges within prior art general conditions is obvious) and In re Boesch, 205 USPQ 215 (CCPA 1980)(discovery of optimum value of result effective variable in a known process is obvious).

Accordingly, it would have been obvious to one of ordinary skill in the art at the time the invention was made to select proper nitrogen releasing parameters to only decompose the second nitride semiconductor epitaxial layer, and thus having the first and third nitride semiconductor epitaxial layers retain their composition because the combination of Chua and Kelly is directed to decompose only the second nitride semiconductor epitaxial layer.

In reference to claims 2 and 16, the combined teachings of Chua and Kelly substantially teach all aspects of the invention but fail to disclose wherein the first and third nitride semiconductor epitaxial layers are made of a material whose equilibrium

vapor pressure of nitrogen is lower than that of the second nitride semiconductor epitaxial layer.

However, the same materials are treated the same way and therefore, the same results would be obtained. Therefore, the combined teachings of Chua and Kelly inherently disclose the claimed limitation.

In reference to claim 3, the combined teachings of Chua and Kelly teach wherein the second nitride semiconductor epitaxial layer is converted into a metal layer in the third step (Chua, column 6, lines 24 – 29).

In reference to claim 4, the combined teachings of Chua and Kelly teach a fourth step of growing a fourth nitride semiconductor epitaxial layer on the third nitride semiconductor epitaxial layer after releasing nitrogen from the second nitride semiconductor epitaxial layer (Chua, column 7, lines 1 – 7).

In reference claim 8, the combined teachings of Chua and Kelly teach wherein the GaN layer is deposited at a temperature of, for example between 500^{o}C and 600^{o}C (Chua, column 4, lines 52 – 65).

Still, the combined teachings of Chua and Kelly fail to fail to disclose depositing said GaN at a temperature in the range of 300^{o}C to 800^{o}C. However, in the case where the claimed ranges “overlap or lie inside ranges disclosed by the prior art” a prima facie case of obviousness exists. MPEP 2144.05. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to use the temperature range disclosed in the combined teachings of Chua and Kelly to arrive at the claimed invention.

In reference to claim 9, the combined teachings of Chua and Kelly teach wherein the GaN layer has a thickness in the range from about 0.1 nm and about 20 nm.

Still, the combined teachings of Chua and Kelly fail to fail to disclose wherein said GaN has a thickness from about 1 nm and 100 nm. However, in the case where the claimed ranges "overlap or lie inside ranges disclosed by the prior art" a prima facie case of obviousness exists. MPEP 2144.05. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to use the thickness range disclosed in the combined teachings of Chua and Kelly to arrive at the claimed invention.

In reference to claim 10, the combined teachings of Chua and Kelly teach wherein III-nitride semiconductor layers are decomposed at temperatures between 600^{o}C and 1800^{o}C (Kelly, column 8, lines 16 – 42).

Still, the combined teachings of Chua and Kelly fail to fail to disclose wherein said InGaN is decomposed at a temperature of 900^{o}C or higher. However, in the case where the claimed ranges "overlap or lie inside ranges disclosed by the prior art" a prima facie case of obviousness exists. MPEP 2144.05. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to use the temperature range disclosed in the combined teachings of Chua and Kelly to arrive at the claimed invention.

In reference to claim 11, the combined teachings of Chua and Kelly teach wherein the first nitride semiconductor epitaxial layer is grown on a substrate (Chua, column 4, lines 30 – 34).

In reference to claim 12, the combined teachings of Chua and Kelly teach wherein the first nitride layer is a GaN buffer layer and a second GaN grown on said buffer layer (Chua, column 4, lines 30 – 51).

In reference to claim 14, the combination of Chua and Kelly disclose a step of separating the first nitride semiconductor epitaxial layer form the other part including the third nitride semiconductor epitaxial layer (Chua, column 6, lines 30 – 52).

5. Claim 7 is rejected under 35 U.S.C. 103(a) as being unpatentable over Chua ('340) in view of Kelly ('604) as applied to claims 1-6, 8-12 and 16-19 above, and further in view of Flynn et al. (U.S. 6,447,604 B1, hereinafter Flynn).

The combined teachings of Chua and Kelly substantially teach all aspects of the invention but fail to disclose wherein the InGaN is deposited at a temperature in the range to 300°C to 800°C.

However, Flynn in teaches a method of forming III-nitride semiconductor layers including the step of depositing InGaN layers at a temperature between about 500°C to about 1000°C (Flynn, column 7, lines 20 – 33).

It would have been within the scope of one of ordinary skill in the art to combine the teachings of Chua and Kelly with Flynn to enable the disclosed deposition step of Chua and Kelly to be performed according to the teachings of Flynn because one of ordinary skill in the art would have been motivated to look to analogous art teaching alternative suitable or useful methods of performing the disclosed deposition step of

Chua and Kelly and art recognized suitability for an intended purpose has been recognized to be motivation to combine. MPEP 2144.07.

In the case where the claimed ranges "overlap or lie inside ranges disclosed by the prior art" a prima facie case of obviousness exists. MPEP 2144.05. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to use the temperature range disclosed in the combined teachings of Chua, Kelly and Flynn to arrive at the claimed invention.

6. Claim 15 is rejected under 35 U.S.C. 103(a) as being unpatentable over Chua et al. (U.S. 6,455,340 B1, hereinafter Chua) in view of Cheung et al. (U.S. 6,071,795, hereinafter Cheung).

Chua (Figs.1-3) teaches a method of forming a nitride semiconductor layer including the steps of growing a second nitride (106) semiconductor epitaxial layer on a first nitride semiconductor epitaxial layer (102, 104), wherein said second nitride semiconductor layer is made of InGaN (Chua, column 5, lines 8 – 13) and said first nitride (102, 104) semiconductor layer is made of undoped GaN (Chua column 4, lines 39 – 51); growing a third nitride (108) made of GaN on the second nitride semiconductor epitaxial layer (106) (Chua, column 5, lines 11 – 15); growing a release layer (114) made of InGaN (114) over said GaN layer (108) (Chua, column 5, lines 20 – 31); and releasing nitrogen from the InGaN layer (104) using an excimer laser procedure (Chua, column 6, lines 14 – 23), wherein the second nitride semiconductor epitaxial layer is converted into a metal layer in the third step (Chua, column 6, lines 24 – 29).

Chua fails to disclose growing a InN layer on the undoped GaN layer and converting the InN layer into a metal layer.

However, Cheung (Figs.1-6) teaches a method of separating thin films including the steps of growing a GaN layer (102) on a carrier substrate (104); releasing said GaN layer (104) from said carrier substrate (102) by a laser treatment process, wherein said process decomposes said GaN into Gallium metal and nitrogen (Cheung, column 4, lines 48 – 65 and column 5, lines 3 – 9). Furthermore, Cheung teaches wherein said separation treatment could be performed to compounds of the (Al, In, Ga)N alloy family such as InN, which exhibit nitrogen release (Cheung, column 6, line 66 – column 7, line 8).

It would have been within the scope of one of ordinary skill in the art to combine the teachings of Chua and Cheung to enable performing the treatment process and separation step of Chua using the materials disclosed in Cheung because one of ordinary skill in the art would have been motivated to look to analogous art teaching alternative suitable or useful methods and materials for the disclosed release layer of Chua and art recognized suitability for an intended purpose has been recognized to be motivation to combine. MPEP 2144.07.

The combination of Chua and Cheung fail to expressly disclose wherein the InN layer releases nitrogen and wherein the un-doped GaN layer and the GaN layer retain their respective nitrogen when the InN layer converts into the metal layer.

However, the combination of Chua and Cheung discloses using the same material and performing the separation by adjusting a heat source such that it

decompose only second nitride layer (Chua, column 6, lines 14 - 40), in this case the InN nitride layer (Cheung, column 6, line 66 – column 7, line 8).

Therefore, since the combination of Chua and Cheung is directed to decompose only the second semiconductor nitride epitaxial layer, the selection of the desired heat specification parameters is obvious because it is a matter of determining optimum process condition by routine experimentation with a limited number of species to obtain a desired decomposed epitaxial layer. In re Jones, 162 USPQ 224 (CCPA 1955)(the selection of optimum ranges within prior art general conditions is obvious) and In re Boesch, 205 USPQ 215 (CCPA 1980)(discovery of optimum value of result effective variable in a known process is obvious).

Accordingly, it would have been obvious to one of ordinary skill in the art at the time the invention was made to select proper nitrogen releasing parameters to only decompose the second nitride semiconductor epitaxial layer, and thus having the first and third nitride semiconductor epitaxial layers retain their composition because the combination of Chua and Cheung is directed to decompose only the second nitride semiconductor epitaxial layer.

Allowable Subject Matter

7. Claim 13 is objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

8. The following is a statement of reasons for the indication of allowable subject matter: the prior art of record fails to disclose a step of patterning the third nitride semiconductor epitaxial layer, prior to the third step, as disclosed in claim 13.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to JULIO J. MALDONADO whose telephone number is (571)272-1864. The examiner can normally be reached on Mon-Fri, 8:00 A.M.-4:00 P.M..

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Matthew Smith can be reached on (571)-272-1907. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/George Fourson/

Primary Examiner, Art Unit 2823

/J. J. M./
Examiner, Art Unit 2823